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EXAMINING GROUP ART UNIT 2623

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of MI-SUEN LEE
Serial No. 09/449,250
Filed: November 24, 1999
Atty. Docket PHA 23-859
Group Art Unit: 2623
Examiner: Chong R. Kim

Title: METHOD & APPARATUS FOR DETECTING MOVING OBJECTS IN VIDEO CONFERENCING AND OTHER APPLICATIONS

APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicant hereby appeals the final rejection dated August 5, 2003, of claims 1 through 20 of the above-identified patent application.

REAL PARTY IN INTEREST

The present application is assigned to Philips Electronics North America Corporation, as evidenced by an assignment recorded on November 24, 1999 in the United States Patent and Trademark Office at Reel 010413, Frame 0564. The assignee, Philips Electronics North America Corporation, is the real party in interest.

RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

STATUS OF CLAIMS

Claims 1 through 20 are pending in the above-identified patent application. Claims 1-5, 9-13 and 18-20 remain rejected under 35 U.S.C. §103(a) as being unpatentable over the combination of Courtney (United States Patent No. 5,969,755), and Abe (United States Patent No. 5,134,472). Claims 6 and 14 remain rejected under 35 U.S.C. §103(a) as being unpatentable over Courtney and Abe, in further view of the article entitled "Grouping into Regions, Curves, and Junctions" by Lee et al. and claims 7, 8, and 15-17 remain rejected under 35 U.S.C. §103(a) as being unpatentable over Courtney and Abe, in further view of Gibbon (E.P. Patent No. 0 635 983 A2).

STATUS OF AMENDMENTS

There have been no amendments filed subsequent to the final rejection.

SUMMARY OF INVENTION

The present invention is directed to a method and apparatus for detection of persons or other objects of interest in a video signal or other type of image signal. (Page 6, line 24, to page 7, line 14.) In accordance with an illustrative embodiment of the invention, a processing system generates, e.g., a threshold difference image by processing an image signal received from a camera. (Page 7, line 27, to page 8, line 5.) The difference image is then segmented into regions bounded by lines, such as vertical lines, passing through the image, and silhouette candidates are identified in one or more of the regions. (Page 8, lines 6-21.) Tensor voting is used to determine saliency values and corresponding tangents for each of

the silhouette candidates, and the resulting values and tangents are used to detect the object of interest. (Page 13, line 10, to page 15, line 21.)

ISSUES PRESENTED FOR REVIEW

i. Whether claims 1-5, 9-13 and 18-20 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over the combination of Courtney, and Abe;

ii. Whether claims 6 and 14 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over Courtney and Abe, in further view of the article entitled "Grouping into Regions, Curves, and Junctions" by Lee et al.; and

iii. Whether claims 7, 8, and 15-17 are properly rejected under 35 U.S.C. §103(a) as being unpatentable over Courtney and Abe, in further view of Gibbon.

GROUPING OF CLAIMS

The rejected claims stand and fall together.

ARGUMENT

Claims 1, 9, and 20 are rejected under 35 U.S.C. §103(a) as being unpatentable over the combination of Courtney and Abe.

The Examiner asserts that, referring to claim 1, Courtney discloses a method for detecting an object of interest in an image processing system. The Examiner further asserts that Courtney discloses the step of segmenting the difference image into a plurality of regions (citing col. 6, lines 27-31 and Figure 7f), but fails to teach that the difference image is segmented into a plurality of regions such that each of the

regions are bounded by one or more lines passing through the entire image. The Examiner asserts, however, that segmenting images into a plurality of regions such that each of the regions are bounded by one or more lines passing through the entire image was exceedingly well known in the art (for example, by Abe).

Applicant notes that the vertical segments cited by the Examiner are vertical segments within a pointing window, not an entire image and, even if the window taught by Abe is considered to be an "entire image," the vertical segments taught by Abe are not utilized for detecting an object of interest in an image processing system. Abe teaches the "details of how the CPU eliminates the boundary between the object and the background" by utilizing the vertical segments illustrated in FIGS. 11 and 12. Col. 10, lines 59-61. At this point in the process, the object of interest has already been detected, as is apparent in FIGS. 10, 11, and 12.

Moreover, even if the method taught by Abe to eliminate the boundary between the object and background is considered to be a method to detect an object of interest, the order of the steps in the method taught by Abe teach away from the order of the steps in the present invention. For example, claim 1 recites segmenting the difference image into a plurality of regions, identifying one or more silhouette candidates in at least a subset of the regions, and detecting the object of interest based at least in part on the identified silhouettes. Thus, the object of interest is detected from the silhouettes that are identified from silhouette candidates in a plurality of regions. The plurality of regions are created (segmented) prior to identifying the silhouettes. Clearly, Abe teaches that the

segmentation of FIGS. 11 and 12 occurs after the identification of the silhouettes of FIG. 10.

Thus, Courtney and Abe, alone or in combination, do not disclose or suggest segmenting the difference image into a plurality of regions, wherein the difference image is segmented into a plurality of regions such that each of the regions are bounded by one or more lines passing through the entire image;

identifying one or more silhouette candidates in at least a subset of the regions; and

detecting the object of interest based at least in part on the identified, as required by each of the independent claims.

Additional Cited References

The Examiner has also cited Lee et al., "Grouping into Regions, Curves, and Junctions" for its disclosure of the determination of saliency values using tensor voting. Lee et al. does not disclose or suggest "segmenting the difference image into a plurality of regions, wherein the difference image is segmented into a plurality of regions such that each of the regions are bounded by one or more lines passing through the entire image," as required by each of the independent claims.

The Examiner has also cited Gibbon (E.P. Patent No. 0 635 983 A2) for its disclosure of the step of detecting a neck position of a moving person by analyzing the sum of x-components of tangents along a corresponding silhouette. Gibbon does not disclose or suggest "segmenting the difference image into a plurality of regions, wherein the difference image is segmented into a plurality of regions such that each of the regions are bounded by one or more lines passing through the entire image," as required by each of the independent claims.

Conclusion

Thus, Courtney, Abe, Lee, and Gibbon, alone or in combination, do not disclose or suggest segmenting the difference image into a plurality of regions, wherein the difference image is segmented into a plurality of regions such that each of the regions are bounded by one or more lines passing through the entire image;

identifying one or more silhouette candidates in at least a subset of the regions; and

detecting the object of interest based at least in part on the identified, as required by each of the independent claims, as required by each of the independent claims.

The rejections of the independent claims under section §103 in view of Courtney and Abe, alone or in any combination, are therefore believed to be improper and should be withdrawn.

The rejected dependent claims are believed allowable for at least the reasons identified above with respect to the independent claims.

The attention of the Examiner and the Appeal Board to this matter is appreciated.

Respectfully,

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Date: December 24, 2003

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CERTIFICATE OF MAILING

It is hereby certified that this correspondence is being deposited on this date with the U.S. Postal Service as first class mail addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450

On December 24, 2003

By Dina Mannix

APPENDIX

1. A method for detecting an object of interest in an image processing system, the method comprising the steps of:

generating a difference image;

segmenting the difference image into a plurality of regions, wherein the difference image is segmented into a plurality of regions such that each of the regions are bounded by one or more lines passing through the entire image;

identifying one or more silhouette candidates in at least a subset of the regions; and

detecting the object of interest based at least in part on the identified silhouettes.

2. The method of claim 1 wherein the object of interest comprises a moving person.

3. The method of claim 1 wherein the difference image comprises a thresholded difference image generated by taking a difference between a first image and a second image and applying binary thresholding to the resulting difference.

4. The method of claim 1 wherein the difference image is segmented into a plurality of regions such that each of the regions are bounded by one or more vertical lines passing through the entire image.

5. The method of claim 1 wherein each of the regions of the image which includes a silhouette candidate includes only a single silhouette candidate.

6. The method of claim 1 further including the step of determining saliency values for each of the silhouette candidates using tensor voting.

7. The method of claim 2 further including the step of detecting a neck position of the moving person by analyzing a sum of x-components of tangents along a corresponding silhouette.

8. The method of claim 7 further including the step of utilizing the detected neck position to determine at least one of a head position and a head size for the moving person.

9. An apparatus for detecting an object of interest in an image processing system, the apparatus comprising:

a camera; and

a processor coupled to the camera and operative (i) to generate a difference image from a signal received from the camera; (ii) to segment the difference image into a plurality of regions, wherein the difference image is segmented into a plurality of regions such that each of the regions are bounded by one or more lines passing through the entire image; (iii) to identify one or more silhouette candidates in at least a subset of the regions; and (iv) to detect the object of interest based at least in part on the identified silhouettes.

10. The apparatus of claim 9 wherein the object of interest comprises a moving person.

11. The apparatus of claim 9 wherein the difference image comprises a thresholded difference image generated by taking a difference between a first image and a second image and applying binary thresholding to the resulting difference.

12. The apparatus of claim 9 wherein the difference image is segmented into a plurality of regions such that each of the regions are bounded by one or more vertical lines passing through the entire image.

13. The apparatus of claim 9 wherein each of the regions of the image which includes a silhouette candidate includes only a single silhouette candidate.

14. The apparatus of claim 9 wherein the processor is further operative to determine saliency values for each of the silhouette candidates using tensor voting.

15. The apparatus of claim 10 wherein the processor is further operative to detect a neck position of the moving person by analyzing a sum of x-components of tangents along a corresponding silhouette.

16. The apparatus of claim 15 wherein the processor is further operative to utilize the detected neck position to determine at least one of a head position and a head size for the moving person.

17. The apparatus of claim 9 wherein the image processing system comprises a video conferencing system.

18. The apparatus of claim 9 wherein the image processing system comprises a video surveillance system.

19. The apparatus of claim 9 wherein the image processing system comprises a human-machine interface.

20. An article of manufacture comprising a storage medium for storing one or more programs for detecting an object of interest in an image processing system, wherein the one or more programs when executed by a processor implement the steps of:

generating a difference image;

segmenting the difference image into a plurality of regions, wherein the difference image is segmented into a plurality of regions such that each of the regions are bounded by one or more vertical lines passing through the entire image;

identifying one or more silhouette candidates in at least a subset of the regions; and

detecting the object of interest based at least in part on the identified silhouettes.